

THE determination of vapour densities at high temperatures by application of the diffusion method of Bunsen is discussed in a paper by Prof. Emich communicated to the Vienna Academy. For one and the same gas at different temperatures the time of diffusion of a given volume should be proportional to the square root of the absolute temperature. Experiments with tubes of porcelain, platinum, and iridium show that this requirement is approximately fulfilled, and investigations on diffusion are now being carried out up to a temperature of 2000° C.

ACCORDING to Mr. W. Ackroyd, colour changes are frequently brought about by the action of radium rays. These changes have been examined by embedding a radium bromide tube in the substance experimented upon. After a few hours sodium chloride becomes orange or buff coloured, potassium chloride becomes violet but returns to its original colour very quickly after removal of the exciting cause. Sodium bicarbonate and potassium metabisulphite are changed to amethyst colour after twenty-four hours' exposure.

WE have received the second number of vol. i. of the *Journal de Chimie physique*, published under the direction of Prof. Guye, of Geneva. The number contains two interesting papers, one by Prof. Duhem on the eutectic and transition points of binary mixtures which give rise to mixed crystals, the other by Prof. Guye on the electrolysis of alkaline chlorides. The reviews of current physicochemical literature which form the second part of the publication are exceedingly well written, and the papers reviewed are, moreover, of quite recent publication, a statement which cannot be made of many abstracts in other physicochemical journals.

IN the November issue of the *Moniteur Scientifique* M. Combes discusses the various attempts which have been made to obtain the diamond artificially. Against the common supposition that the diamond can only be produced at high temperatures, the author cites several observations which seem to indicate that natural diamonds, at any rate, cannot have been formed under such conditions. The hypothesis that high pressures are necessary for the artificial production of diamonds is not in accord with actual experimental facts, and the author arrives at the conclusion that in the experiments of Moissan the pressure plays no essential part, and that the optical properties and the analysis of the crystals obtained by this chemist do not warrant the conclusion that these are to be regarded as diamonds.

THE additions to the Zoological Society's Gardens during the past week include a Bonelli's Eagle (*Nisaetus fasciatus*), European, presented by Mr. G. H. Baxter; a Matamata Terrapin (*Chelys fimbriata*) from Guiana, presented by Mr. E. Bieber; a Yellow-fronted Amazon (*Chrysotis ochrocephala*) from Guiana, a Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*) from Moluccas, a Common Buzzard (*Buteo vulgaris*), European, deposited; an Orang-outang (*Simia satyrus*) from Borneo, purchased.

## OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN DECEMBER:—

- Dec. 3. 6h. 44m. Minimum of Algol ( $\beta$  Persei).  
 6. 17h. 40m. to 18h. 41m. Moon occults  $\lambda$  Geminorum (Mag. 3.6).  
 11. Predicted perihelion passage of Brooks's periodical comet (1889 V—1896 VI).  
 11–13. Epoch of Geminid Meteors (Radiant  $108^\circ + 33^\circ$ ).  
 14. 12h. Venus in conjunction with the Moon. Venus  $0^\circ 5' S$ .

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- Dec. 15. Venus. Illuminated portion of disc = 0.586.  
 16. 3h. 7m. to 6h. 26m. Transit of Jupiter's Sat. III.  
 20. 12h. Mars and Saturn in conjunction (Mars  $0^\circ 33' S$ ).  
 22. 12h. Sun enters Capricornus. Winter commences.  
 23. 7h. 17m. to 10h. 36m. Transit of Jupiter's Sat. III.  
 „ 8h. 27m. Minimum of Algol ( $\beta$  Persei).  
 25. 6h. 0m. Jupiter in conjunction with the moon (Jupiter  $2^\circ 40' S$ ).  
 26. 5h. 16m. Minimum of Algol ( $\beta$  Persei).  
 „ 23h. 0m. Neptune in opposition to the sun.  
 31. 12h. 50m. Near approach of moon to Aldebaran ( $\alpha$  Tauri).  
 „ 18h. 0m. Mercury at greatest elongation ( $19^\circ 30' E$ .)

DETERMINATION OF STANDARD STELLAR VELOCITIES.—In accordance with the cooperative scheme for regularly determining the velocities of certain standard stars, Profs. Frost and Adams have, during the past twelve months, made independent observations of the radial velocities of thirteen stars, the results of which are given herewith:—

Star	Mean velocity in kilometres per sec.
$\alpha$ Arietis ... ..	– 13.7
$\alpha$ Persei ... ..	– 2.1
$\beta$ Leporis ... ..	– 12.4
$\beta$ Geminorum ... ..	+ 3.4
$\alpha$ Crateris ... ..	+ 47.4
$\alpha$ Bootis ... ..	– 4.8
$\beta$ Ophiuchi ... ..	– 11.1
$\gamma$ Aquilæ ... ..	– 1.8
$\gamma$ Cephei ... ..	– 41.2
$\epsilon$ Pegasi ... ..	+ 6.2
$\gamma$ Piscium ... ..	– 10.9
$\epsilon$ Aurigæ ... ..	+ 19.0
$\epsilon$ Leonis ... ..	+ 5.5

The Bruce spectrograph of the Yerkes Observatory, with various cameras attached, has been used, and, in the majority of cases, the spark spectrum of titanium has been employed to give the standard comparison wave-lengths. Three photographs of each star have been obtained, except in the case of  $\beta$  Leporis, where the low altitude and poor observing conditions have prevented more than one being taken. A range of 1.8 km. in the determined velocities of  $\epsilon$  Leonis indicates the existence of a real variation, but more photographs must be measured before the point can be decided. An unaccountable difference of  $-0.5$  km. is shown between the velocity of Arcturus as determined from eight earlier plates and that obtained from the five plates recently obtained, unaccountable because in the spectrum of this star the lines are so well defined (*Astrophysical Journal*, vol. xviii., No. 4).

NEW ELEMENTS FOR  $\eta$  AQUILÆ.—From 352 observations of the magnitude of  $\eta$  Aquilæ, made at the Lyons Observatory between June 3, 1898, and December 22, 1902, M. M. Luizet obtained the times of fifty-five maxima and fifty-three minima, and, on comparing them with those calculated from the elements obtained by Schür, and published in "Chandler's Third Catalogue," he found that a difference amounting, in the mean, to  $+0.2$  day existed, and therefore thought it advisable to compute a new set of elements. This he did by employing the maxima and minima data used by Schür, and combining with them the results obtained from his own observations; the result showed that it was necessary to apply a correction of  $0.106 \pm 0.021$  day to the original epoch of maxima, and  $0.0166 \pm 0.035$  day to that of minima, and, in each case, a slight correction to the length of the period.

Applying these corrections to the data used by Schür, one obtains for the original epochs

Maxima 2396168.738 days,  
 Minima 2396166.365 days,

and for the length of the period

7.176382 days.

The new elements, based on these data, are as follows :—  
 Maximum = J.D. 2396 168<sup>7</sup>381 (M.T. Paris) + 7<sup>1</sup>76382 E.  
 Minimum = J.D. 166<sup>3</sup>365 f + 0<sup>1</sup>14 sin (0<sup>0</sup>044 E. + 304°)  
 or

d. h. m. s. d. h. m. s.  
 Maximum 1848 May 20 17 42 43 + 7 4 13 59<sup>4</sup> E.  
 Minimum „ „ 18 8 45 36 f + 202m. sin (0<sup>0</sup>044 E. + 304°)

and a comparison of the weighted means of his own and other observations leads M. Luizet to the conclusion that the interval between the principal and secondary maxima is 2.373 days, or 2d. 8h. 58m. (*Astronomische Nachrichten*, No. 3911).

ABSORPTION OF STAR LIGHT BY COMET 1903 c.—Prof. Max Wolf publishes, in No. 3914 of the *Astronomische Nachrichten*, two photographs of comet 1903 c taken on July 25 when the comet was passing in front of the 6.5 magnitude star B.D. + 63° 1056. On comparing these photographs with the observations of comet 1902 III., Prof. Wolf arrives at the conclusion that the later comet exhibited a selective absorption of star light which was not exhibited by the earlier one.

PUBLICATIONS OF THE PULKOWA OBSERVATORY.—Vol. x. (2nd series) of the *Publications de l'Observatoire Central Nicolas*, edited by M. M. Nyrén, contains the details of the observations made with the prime-vertical transit instrument from 1869 to 1896. In the introduction, M. Nyrén discusses very minutely the errors of the instrument and their corrections, paying particular attention to the causes which might produce a small yet persistent residual as yet unaccounted for.

The results were analysed in order to test the validity of Chandler's " $\Delta\phi$ " term for the variation of latitude, and they indicate that that observer's empirical formula requires some slight modification, although M. Nyrén hesitates to make a definite statement on this point. The constant of aberration as deduced from these observations is 20<sup>0</sup>.4423 if Chandler's term be considered; without the latter the value is 20<sup>0</sup>.4451, and M. Nyrén observes that, in the mean, this term seems of small importance.

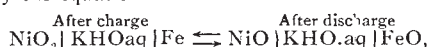
In vol. xiii. of the same *Publications* M. Nyrén publishes a new catalogue of 1336 reference stars situated between dec. -30° and dec. +90°. This differs from Struve's Pulkowa catalogue in only containing stars between magnitudes 5 and 7; at least this was the original proposal, but it has been found necessary in practice to admit others which are just outside these limits. The idea of this selection was to include stars which were faint enough to give exact readings, and not too faint to be observed with the vertical circle used. Another feature of the catalogue is the division of the zone into squares, of which each side is 5° in length, and the observation of only one star in each zone, thus ensuring the even distribution of the reference positions without incurring too great a labour in the observations. The section of the zone -15° to +90° was observed at Pulkowa, and stars selected from the Bonn Durchmusterung were used, whilst the remaining section was observed at the subsidiary observatory at Odessa, where the Cordoba catalogue was used. Details of each observation made are given in the catalogue, and, together with the results, they occupy 487 quarto pages.

GUIDE FOR ASTRONOMICAL AND GEODETICAL CALCULATIONS.—Part ii. of Signor J. Boccardi's "*Guide du Calculateur*" will be found to be an extremely useful reference book by all who desire to perform calculations of observational results in astronomy or geodesy. It gives lucid explanations of many typical computations, such as the calculation of precessional effects, reductions to apparent place, elements of orbits, the determination of an orbit from three observations, and the special perturbations of an orbit; it also explains and illustrates the method of "least squares." Under the heading of "Geodesy" the solutions of many typical problems are explained and examples worked out,

several special methods being named and clearly elucidated. Numerous worked examples are given throughout the book, each problem and method being clearly illustrated in this manner. The work is published by M. A. Hermann, 6 Rue de la Sorbonne, Paris.

### THE EDISON ACCUMULATOR.<sup>1</sup>

MR. W. HIBBERT read a most interesting paper on the Edison accumulator before the Institution of Electrical Engineers last week. Since the first announcement of Mr. Edison's invention nearly three years ago, very little of an authoritative nature has been published about the cell; the paper which Dr. Kennelly read in May, 1901, showed that the invention was full of promise, and further results of more extensive experiments and of practical trials have since been awaited with eagerness. A description of the cell itself was published in *NATURE* in July, 1901 (vol. lxi. p. 241), and as it has undergone little alteration since then we need not describe it in detail here; the active materials, it will be remembered, are nickel oxide and iron, and the electrolyte is a 20 per cent. solution of caustic potash; the chemical changes on charge and discharge may be represented by the equation



the electrolyte serving merely as an oxygen carrier, and not taking any actual part in the final changes of the active material, as does the sulphuric acid in the lead-lead-peroxide cell. The active materials are packed in perforated steel pockets, and the plates, though thin, are rigid and light. The construction is thoroughly mechanical throughout, and the lightness is obtained without any sacrifice of durability,

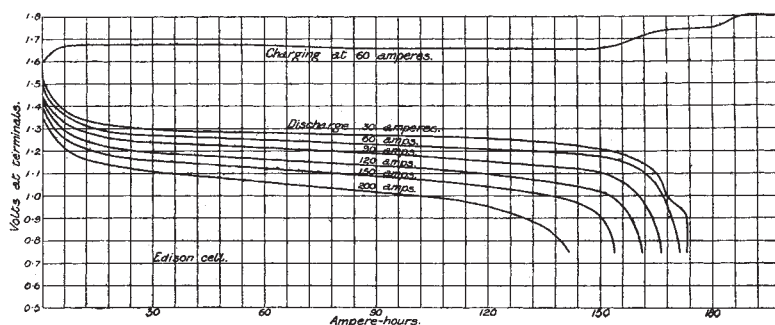


FIG. 1.—Discharge Curves of Edison Cell. From the *Journal of the Institution of Electrical Engineers*.

which is one of the chief faults of the lighter types of lead cells. The standard size of automobile cell is 13 inches high (over all) and 5.1 × 3.5 inches horizontally. The weight is 17.8 lb. The E.M.F. is approximately 1.35 volts, and the internal resistance 0.0013 ohm; the output at 60 amperes discharge is 210 watt-hours, the capacity working out, therefore, at 11.8 watt-hours per lb. This figure agrees very closely with those which were published originally; Dr. Kennelly put the output at about 14 watt-hours per lb., and, in the article referred to above, we calculated from a discharge curve which had been published an output of 10 watt-hours per lb. The lightest lead cells in some instances approach, or even exceed these figures, but on the average the result is considerably better than that obtainable in practice with lead accumulators. It will be seen, however, that in many other respects the Edison cell promises to prove much superior, especially for motor-car work.

Mr. Hibbert's tests were made partly under laboratory conditions and partly on the road. The discharge curves reproduced in Fig. 1 were taken in the laboratory, and show that the Edison cell possesses in a remarkable degree one very desirable characteristic, namely, that of giving a good output in ampere-hours when discharged at heavy discharge rates. Taking the normal discharge current as 30 or 40

<sup>1</sup> "The Edison Accumulator for Automobiles." By W. Hibbert. Abstract of paper read before the Institution of Electrical Engineers. November 26.